Measuring Social Support for Healthy Eating and Physical Activity in Obesity

Elizabeth Rieger[1*], Martin Sellbom[2], Kristen Murray[3], and Ian Caterson[4]

[1]Research School of Psychology, Australian National University, Canberra, Australia

[2]Department of Psychology, University of Otago, Dunedin, New Zealand

[3]Discipline of Psychology, University of Canberra, Canberra, Australia

[4]Boden Institute of Obesity, Nutrition, Exercise and Eating Disorders, Charles Perkins Centre, University of Sydney, Sydney, Australia

Word count: 4994

Conflict of interest statement: The authors declare no conflict of interest.

Funding: This work was supported by the National Health and Medical Research Council of Australia (632621).

***Requests for reprints should be addressed to:** Associate Professor Elizabeth Rieger, Research School of Psychology, Australian National University, Acton ACT 2601, Australia. E-mail: Elizabeth.Rieger@anu.edu.au

Abstract

Objectives: This study sought to investigate the psychometric properties of two commonly used measures of social support in obesity, namely, the Social Support for Eating Habits (SSEH) and Social Support for Physical Activity (SSPA) scales. ***Design:*** Cross-sectional and longitudinal study design. ***Methods:*** Participants were 200 adults with obesity taking part in a 12-month cognitive behavioural weight loss program. At pre-treatment, participants completed the SSEH and SSPA as well as measures of social support, motivation, self-efficacy, and health-related quality of life to assess concurrent validity. Predictive validity was assessed in terms of baseline SSEH and SSPA scores predicting post-treatment weight while controlling for pre-treatment weight. ***Results:*** Factor analysis supported a two-factor solution for both the SSEH ("Encouragement" and "Discouragement") and SSPA ("Participation" and "Punishment") scales, with each subscale demonstrating acceptable internal consistency. While the results provided some support for the concurrent validity of the SSEH Discouragement and SSPA Participation subscales, there was mixed support for the SSEH-Encouragement subscale and poor support for the SSPA Punishment subscale. No support was found in terms of predictive validity. ***Conclusions:*** The findings question the validity of the SSEH and SSPA scales in obesity, with behaviours deemed to be supportive in non-obese populations not necessarily perceived as such by people with obesity. The development of a psychometrically-sound measure of social support in the obesity context is needed.

Keywords: obesity, social support, eating, physical activity, measurement

Measuring Social Support for Healthy Eating and Physical Activity in Obesity

Social support is a complex construct that broadly refers to "any process through which social relationships might promote health and well-being" (Cohen, Gottlieb, & Underwood, 2000, p. 4), entailing the provision of emotional, informational, appraisal, and/or instrumental resources from various sources such as family members and friends (Berkman & Krishna, 2014). It is a well-established predictor of psychological and physical morbidity and mortality (Berkman & Krishna, 2014), having been found to be comparable to, or even exceed, traditional risk factors (e.g., cigarette smoking, alcohol consumption, and physical activity) (Holt-Lunstad, Smith, & Layton, 2010).

Studies utilising diverse methodologies have yielded results also suggestive of an association between social support and positive obesity-related variables. For example, baseline social support predicts weight loss among individuals participating in a behavioural weight loss program (Prochaska, Norcross, Fowler, Follick, & Abrams, 1992) and treatment studies that have sought to enhance social support in adults with obesity have resulted in more positive outcomes (Leahey & Wing, 2013; Wing & Jeffery, 1999). As well as addressing weight change, research has also investigated the role of social support as a predictor of weight-related behaviours. For instance, a systematic review that evaluated 25 psychosocial predictors of fruit and vegetable consumption across 35 studies found that social support was one of only three variables (along with self-efficacy and dietary knowledge) for which strong support was found (Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008).

While the studies presented thus far are suggestive of a link between social support and improved outcomes in obesity, there are also some noteworthy exceptions, with some research, for example, reporting that higher pre-treatment social support is in fact predictive of less weight loss (Ball & Crawford, 2006; Kiernan et al.; 2012; Wing & Jeffery, 1999;

Yank, Xiao, Wilson, Stafford, Rosas, & Ma, 2014). Possibly contributing to the conflicting findings is the pervasive use of instruments of unknown psychometric status for assessing social support in obesity. The measures of social support that have been most widely utilised in the obesity literature are the Social Support for Eating Habits (SSEH) and the Social Support for Physical Activity (SSPA) scales, each of which includes versions assessing support from either family or friends (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). Given their common use in obesity research (e.g., Ball & Crawford, 2006; Kiernan et al., 2012; Wing & Jeffery, 1999; Yank, Xiao, Wilson, Stafford, Rosas, & Ma, 2014), establishing the psychometric soundness of these scales in this context is needed.

The absence of social support instruments whose psychometric properties have been comprehensively evaluated for use in the obesity field is a noteworthy gap as it limits research seeking to understand the role of social support in obesity. Given their utilisation but unknown psychometric status in the obesity context, the primary aim of the present study is to evaluate the psychometric properties of the SSEH and SSPA scales in a sample of adults with obesity participating in a cognitive behavioural weight loss program. The following research questions will be evaluated:

1. Is the original factor structure of the SSEH and SSPA scales replicated in a sample of adults with obesity?
2. What is the internal consistency of the SSEH and SSPA subscales that emerge in the factor analysis?
3. Is the concurrent validity of the SSEH and SSPA scales supported in terms of significant associations with related measures? If valid, the SSEH and SSPA should be highly correlated with other measures of social support for weight management. Albeit more modestly, the SSEH and SSPA should also be correlated with variables known to be related to social support including measures of eating behaviours

(primarily for the SSEH scale), physical activity (primarily for the SSPA scale), motivation for change (e.g., Prochaska & Velicer, 1997), self-efficacy (e.g., Shao, Liang, Shi, Wan, & Yu, 2017), and health-related quality of life (e.g., Berkman & Krishna, 2014)? If valid, there should be a positive association between the positive support subscales (i.e., the SSEH-Encouragement and SSPA-Participation subscales) and the positive dimensions of these constructs. Conversely, there should be a negative association between the negative support subscales (i.e., the SSEH-Discouragement and SSPA-Rewards and Punishments subscales) and the positive dimensions of these constructs.

4. Is the predictive validity of the SSEH and SSPA scales supported in terms of higher pre-treatment levels of social support significantly predicting greater weight loss at the end of treatment?

Method

Participants

Participants in this study took part in a two-arm, randomised controlled trial investigating the effectiveness of a one-year group cognitive behavioural (CBT) weight loss program either alone (CBT-A) or with the addition of a support person (CBT-SP) trained to provide weight management support for people with obesity (see Rieger, Treasure, Murray, and Caterson [2017] for full details of the trial outcomes). Participants were eligible to take part if they were aged 18 years or older, and had a body mass index (BMI = kg/m^2) of 30 or greater. The study was approved by the relevant institutional review boards. All participants provided informed consent to take part in the study. Baseline characteristics of the 200 participants who were randomised to one of the two treatment conditions are shown in Table 1.

Measures

Participants completed the following self-report questionnaires at pre-treatment. Cronbach's alphas are shown in Table 2.

Social Support for Eating Habits (SSEH) and Social Support for Physical Activity (SSPA) scales. The SSEH scale (Sallis et al., 1987) is a 10-item self-report questionnaire assessing the frequency of support received from others for healthy eating habits over the past three months on scale from 1 (*none*) to 5 (*very often*). It is comprised of a five-item Encouragement and a five-item Discouragement subscale. Given the weight loss focus of the present research, items referring to salt were modified to refer to sugar (e.g., "Ate high-sugar or high fat foods in front of me"). The SSPA scale (Sallis et al., 1987) is a 13-item self-report questionnaire assessing the frequency of support received from others for engaging in physical activity over the past three months on scale from 1 (*none*) to 5 (*very often*). It is comprised of a 10-item Participation and a three-item Rewards and Punishments subscale. There are two versions of both the SSEH and the SSPA, measuring support from family and friends separately.

Quality of Relationships Inventory. The QRI (Pierce, Sarason, & Sarason, 1991) is a 25-item self-report questionnaire comprised of three subscales assessing the perceived level of support (e.g., "To what extent could you turn to this person for advice about problems?"), conflict (e.g., "How often do you need to work hard to avoid conflict with this person?"), and depth (e.g., "How significant is this relationship in your life?") in a specified relationship. In the present study, in order to provide another measure of social support specifically for weight loss, participants in the CBP-SP were asked to complete the QRI in reference to the person being trained in the trial to support their weight loss efforts. Research attests to the validity of the QRI (Pierce et al., 1991).

Binge Eating Scale. The BES (Gormally, Black, Daston, & Rardin, 1982) is a 16-item self-report questionnaire assessing the tendency to engage in various forms of problem eating

behaviours (e.g., loss of control over eating, emotional eating, and overeating) among adults with obesity. Higher scores indicate greater problematic eating behaviours. The validity of the BES has been supported in terms of associations with other measures of eating pathology (Cotter & Kelly, 2017).

International Physical Activity Questionnaire. The long form of the IPAQ (Craig et al., 2003) is a 27-item self-report questionnaire that assesses the amount of physical activity in the past seven days across three levels of activity (walking, moderate-intensity, and vigorous-intensity) and four domains (leisure time physical activity, domestic activities, work-related physical activity, and transport related physical activity). A total physical activity score is calculated by weighting each type of activity by its energy requirements (defined in METs) to yield a score in MET–minutes/week (i.e., multiplying the MET score of an activity by the minutes performed and the number of days it was performed); the total score is the summation of the MET-minutes/week across each intensity and domain of physical activity. There is support for the IPAQ's reliability and validity (Craig et al., 2003).

Decisional Balance Inventory. The DBI (O'Connell & Velicer, 1988) is a 20-item self-report questionnaire measuring motivation for losing weight that is comprised of two subscales assessing the pros (e.g., "My self-respect would be higher if I lost weight") and cons (e.g., "The exercises needed for me to lose weight would be a drudgery") of weight loss. Each item is rated for its importance in terms of making a decision to lose weight on a scale from 1 (*not at all important*) to 5 (*extremely important*). The DBI-Pros and DBI-Cons subscales have validity support (O'Connell & Velicer, 1988).

Weight Efficacy Lifestyle Questionnaire. The WEL (Clark, Abrams, Niaura, Eaton, & Rossi, 1991) is a 20-item self-report questionnaire assessing self-efficacy or confidence in managing one's eating across situations that entail a high-risk for overeating (e.g., "I can resist eating when I am depressed"). It is comprised of five subscales including negative

emotions, availability of food, social pressure to eat, physical discomfort, and positive activities. Items are scored on a scale from 0 (*not confident at all that I can resist the desire to eat*) to 9 (*very confident that I can resist the desire to eat*). Subscale scores are added to yield a total score, with higher scores indicating greater self-efficacy. There is support for the WEL in terms of its validity (Clark et al., 1991; Clark, Carghill, Medeiros, & Pera, 1996).

Dietary Fat and Physical Activity: Pros, Cons, and Confidence Scales. A series of scales were administered that assessed pros/cons and self-efficacy specifically in relation to dietary fat and physical activity (Robinson et al., 2008). The Dietary Fat Pros and Cons scale and the Physical Activity Pros and Cons scale are both eight-item self-report questionnaires comprised of two subscales assessing the pros (e.g., "Foods high in fat taste better than low fat foods") and cons (e.g., "Eating high fat foods now can mean health problems for me in the future") of consuming fat, and the pros (e.g., "Regular physical activity would help me manage my weight") and cons (e.g., "Regular physical activity would take too much time") of engaging in physical activity, respectively. Each item is rated for its importance in terms of making a decision to eat high fat foods or engage in physical activity on a scale from 1 (*not at all important*) to 5 (*extremely important*). The Dietary Fat-Confidence scale and the Physical Activity-Confidence scale are five- and six-item self-report questionnaires assessing level of self-efficacy to choose low fat foods (e.g., "When you are craving high fat foods") and to engage in physical activity (e.g., "When you are tired"), respectively on a scale from 1 (*not at all confident*) to 5 (*extremely confident*). Research generally supports the validity of these scales (Robinson et al., 2008).

Impact of Weight on Quality of Life-Lite. The short version of the IWQOL (Kolotkin, Crosby, Kosloski, & Williams, 2001) is a 31-item self-report questionnaire assessing the perceived impact of obesity (e.g., "Because of my weight I have difficulty getting up from chairs") across five domains of functioning including physical function, self-

esteem, sexual life, public distress, and work. Items are scored on a scale from 1 (*never true*) to 5 (*always true*). Subscale scores are summed to yield a total score with higher scores indicating a greater negative impact of weight on functioning. There is strong support for the IWQOL-Lite in terms of reliability and validity (Kolotkin et al., 2001).

Data Analysis

The data from the two treatment conditions were combined for the statistical analyses unless otherwise stated. A series of confirmatory factor analyses (CFA) was initially undertaken to test the original factor models using a robust weighted least squares estimator (WLSMV) in M*plus* 7 (Muthén & Muthén, 2012) to account for ordered categorical data. Standard model fit statistics were considered, with confirmatory fit index (CFI) $\geq$ .90, Tucker-Lewis Index (TLI) $\geq$ .90, Root Mean Squared Error of Approximation (RMSEA) $\leq$ .08, and weighted root mean square residual < .95 as indicators of acceptable fit. The overall chi square value was also considered, but is too sensitive to sample size. In the event that CFA models would fail to sufficiently fit the observed data, an *a priori* decision was made to consider exploratory factor analysis (EFA) to determine the optimal structure in the current sample. WLSMV estimation and geomin rotation were used for such analyses. Model fit criteria (SRMR rather than WRMR as provided for EFA) were used to select an adequate fitting model, and theoretical consideration and factor viability (eigenvalues) were used to determine the optimal model among adequately fitting alternatives.

Internal consistency estimates for the final subscales were calculated using Cronbach's alpha and, due to the brevity of some scales, average inter-item correlations (AIC). Concurrent validity was evaluated using Pearson correlation coefficients in terms of concurrent associations between the SSEH and SSPA subscale scores and each of the external criteria at baseline. The predictive validity of the SSEH and SSPA subscales for weight loss at post-treatment was evaluated through a series of hierarchical regression

analyses with pre-treatment weight and condition entered in Block 1, social support in Block 2, and a condition×social support interaction in Block 3.

Results

Factor Analysis

Table 3 (upper panel) lists the model fit indices for the CFAs for the four measures. Only the SSEH-Family scale received adequate support. The two-factor model was associated with a slightly large RMSEA value, but small sample sizes and small models often artificially increase this value (MacCallum, Browne, & Sugawara, 1996). The remaining fit indices were acceptable to excellent. The SSEH-Friends scale model did not adequately fit the data (but loadings from this model can be found in the online supplement Table S1). The SSPA-Friends scale model was associated with acceptable model fit; however, Item 9 was associated with an out of bounds value (negative residual). Attempts to respecify (e.g., constraining the residual to zero; dual loading on both factors) resulted in other Heywood cases. The SSPA-Family scale would not converge altogether due to problems with Item 7.

Because only one of the four measures met the acceptable model fit criteria for CFA, EFA was conducted to evaluate the optimal factor structure for the remaining three measures in the current sample. Table 3 (lower panel) lists the model fit statistics for viable models (eigenvalues > 1.00); in each case, only one- and two-factor models were deemed viable in terms of accounting for an adequate proportion of variance in the items. Moreover, in each of these EFAs, the one-factor model did not achieve adequate model fit, whereas the two-factor models were associated with acceptable model fit statistics, with the exception of RMSEA (and SRMR for the SSPA-Family model). However, the latter fit index has been criticised for being artificially large in small models and in small sample sizes (MacCallum et al., 1996), which was the case here.

Factor loadings with an absolute value of .40 or larger were deemed meaningful. These were derived from the CFA results for the SSEH-Family scale and EFA results for the remaining scales. An inspection of the factor loadings (see Tables 4 and 5) indicates that the SSEH and SSPA two-factor structures mapped onto those identified in Sallis et al. (1987) with minor exceptions. First, for the two SSPA scales, Item 9 (i.e., family/friends "Gave me rewards for being physically active") loaded preferentially with the Participation factor rather than the Rewards and Punishments factor, and was thus included in the Participation subscale in subsequent analyses, and the Rewards and Punishments subscale was re-named as the Punishment subscale to accurately convey its revised content. Second, unlike in the study by Sallis et al., the SSPA-Friends scale emerged with a two-factor structure very similar to that of the SSPA-Family scale. Thus, based on these results, it was concluded that there was support for the SSEH Encouragement (Factor 1) and Discouragement (Factor 2) factors as well as the slightly revised SSPA Participation (Factor 1) and Punishment (Factor 2) factors.

To evaluate factor overlap, factors within each of the scales were correlated. Factor intercorrelations were .20 ($p < .005$) for the SSEH-Family Encouragement and Discouragement subscales, .30 ($p < .001$) for the SSEH-Friend Encouragement and Discouragement subscales, .05 ($p = .52$) for the SSPA-Family Participation and Punishment subscales, and .12 ($p = .09$) for the SSPA-Friend Participation and Punishment subscales.

Internal Reliability

The SSEH-Family subscales exhibited excellent internal consistency reliability estimates. The Encouragement subscale evinced a Cronbach's alpha of .90, AIC of .65, and McDonald's omega of .93; the Discouragement subscale had an alpha of .87, AIC of .57, and McDonald's omega of .90. Similarly, the SSEH-Friends Encouragement subscale yielded a Cronbach's alpha of .89, AIC of .62, and McDonald's omega of .89; the SSEH-Friends

Discouragement subscale exhibited an alpha of .78, AIC of .42, and McDonald's omega of .82.

The SSPA-Family Participation subscale also demonstrated excellent internal consistency with an alpha of .90, AIC of .44, and McDonald's omega of .93. The SSPA-Family Punishment subscale had an alpha of only .60 (due to having only two items) but had high internal consistency as shown by an AIC of .47 (Clark & Watson, 1995) and McDonald's omega of .79. The SSPA-Friends Participation subscale exhibited excellent internal consistency, showing an alpha of .92, AIC of .51, and McDonald's omega of .96. The SSPA-Friends Punishment subscale had an alpha of only .55 but had acceptable internal consistency as shown by an AIC of .39 (Clark & Watson, 1995) and McDonald's omega of .77.

Concurrent Validity

To assess construct validity, the correlations between both the SSEH-Family and SSEH-Friend subscales and measures of related constructs at baseline are shown in Table 6. Supporting its validity, the SSEH-Family Encouragement subscale was positively associated with support from a significant other involved in weight management support (QRI-Support), the pros of weight loss (DBI-Pros), and the cons of consuming high fat foods (DF-Cons). However, the SSEH-Family Encouragement subscale was also positively associated with problem eating behaviours (BES) and the cons of weight loss (DBI-Cons).

Supporting the negative aspects of social support from family for eating as measured by the SSEH-Family Discouragement subscale, these scores were positively associated with problem eating behaviours (BES), the cons of weight loss (DBI-Cons), and the cons of physical activity (PA-Cons), and were negatively associated with confidence for controlling one's eating when experiencing negative emotions (WELQ-Negative Emotions), social pressure to eat (WELQ-Social Pressure), physical discomfort (WELQ-Physical Discomfort),

and engaged in positive activities (WELQ-Positive Activities), confidence for reducing dietary fat (DF-Confidence), and the impact of weight on one's self-esteem (IWQOL-Self Esteem), sexual functioning (IWQOL-Sexual Life), and stigma-related concerns (IWQOL-Public Distress). However, unexpectedly, the SSEH-Family Discouragement subscale was also positively associated with the pros of weight loss (DBI-Pros).

Although its focus in on healthy eating habits, the SSEH-Friends Encouragement subscale had concurrent positive associations with amount of physical activity (IPAQ) and the pros of physical activity (PA-Pros). Akin to the family version of this subscale, the SSEH-Friends Encouragement subscale was also positively correlated with awareness of the cons of consuming dietary fat (DF-Cons). However, as with the family version of this subscale, the SSEH-Friends Encouragement subscale had an unexpectedly positive association with problem eating behaviours (BES). It was also unexpectedly associated with lower confidence for controlling one's eating when experiencing negative emotions (WELQ-Negative Emotions) and when engaged in positive activities (WELQ-Positive Activities), and with greater negative impact of weight in terms of one's physical functioning (IWQOL-Physical Function) and stigma-related concerns (IWQOL-Public Distress). As with the Family version of this subscale, the SSEH-Friends Discouragement subscale had concurrent positive associations with problem eating behaviours (BES), the cons of losing weight (DBI-Cons), and the impact of weight in terms of stigma-related concerns (IWQOL-Public Distress).

The correlations between both the SSPA-Family and SSPA-Friend subscales and measures of related constructs at baseline are also shown in Table 6. The SSPA-Family Participation subscale was, as expected, positively correlated with the degree of support (QRI-Support) and depth (QRI-Depth) in the relationship with a significant other involved in the participant's weight management support. The SSPA-Family Participation subscale was

also positively associated with amount of physical activity (IPAQ), confidence to engage in physical activity (PA-Confidence), and awareness of the cons of dietary fat (DF-Cons). However, the SSPA-Family Participation subscale was unexpectedly found to be negatively associated with the impact of weight on sexual functioning (IWQOL-Sexual Life). The only significant correlation for the SSPA-Family Punishment subscale was its unexpected positive association with greater self-efficacy for resisting overeating when food is available (WEL-Availability).

As expected, the SSPA-Friend Participation subscale evinced positive associations with amount of physical activity (IPAQ), confidence for engaging in physical activity (PA-Confidence), and awareness of the pros for engaging in physical activity (PA-Pros) while being negatively associated with the cons of physical activity (PA-Cons). However, unexpectedly, the SSPA-Friend Punishment subscale was also positively associated with amount of physical activity (IPAQ), the pros of physical activity (PA-Pros), and awareness of the cons of consuming dietary fay (DF-Cons).

Predictive Validity

Prior to running predictive models, participants who did and did not complete post-treatment weight measures were compared using one-way ANOVA on baseline SSEH and SSPA scores to assess for differences based on attrition. As no differences were indicated, predictive models employing completer data were assessed. Results of the hierarchical regression models are presented in Tables 7 and 8. No significant effects for social support or its interaction with condition on post-treatment weight were found when controlling for pre-treatment weight and intervention condition. Therefore, perceived social support from family and friends in relation to healthy eating and physical activity were not found to predict greater weight loss.

Discussion

The present study sought to provide a comprehensive evaluation of the psychometric properties of the SSEH and SSPA scales in a sample of adults with obesity. Factor analysis yielded the same two-factor solution comprised of the same items as the original research utilising these measures in a predominantly student sample (Sallis et al., 1987) for the SSEH subscales (i.e., Encouragement and Discouragement). However, there were slight differences for the SSPA subscales (i.e., Participation and Rewards and Punishments). Specifically, a two-factor structure was evident in both the family and friend versions of these scales, which is somewhat inconsistent with Sallis et al. who did not find support for the Rewards and Punishments subscale in the friend version of the SSPA. In addition, an item focusing on offering rewards for physical activity loaded on the Rewards and Punishments factor in the Sallis et al. study whereas it loaded predominantly on the Participation factor in the present study. The removal of this item resulted in a more interpretable subscale entailing purely negative forms of support (i.e., punishing the individual for engaging in physical activity), which was thus re-labelled as the Punishment subscale. Each of the four subscales had acceptable internal consistency (as evidenced via Cronbach's alphas and/or average inter-item correlations) in both the family and friend versions.

Despite largely replicating the original factor structures, the study found mixed support for the concurrent validity of the SSEH and SSPA subscales in an obese sample. The most consistent support was observed for the concurrent validity of the SSEH Discouragement (especially the Family version) and the SSPA Participation subscales. In the case of the SSEH Discouragement subscale, greater discouragement from significant others for engaging in healthy eating was associated with higher engagement in problem eating behaviours and higher perceived cons of weight loss as well as broader psychological constructs such as greater negative impact of obesity on quality of life. In the case of the SSPA Participation subscale, greater encouragement and participation from significant others in physical activity

was associated with greater engagement in physical activity and confidence for engaging in physical activity as well as other constructs such as greater perceived support from a significant other supporting the person's weight loss efforts.

In contrast, there was only partial support for the SSEH Encouragement subscale. For example, while higher encouragement for engaging in healthy eating was associated with higher perceived support from a significant other involved in weight management support, it was also associated with *greater* engagement in problem eating behaviours. While the latter finding could indicate that people experiencing more eating difficulties elicit greater eating-related support from family and friends, it could also indicate that eating-related comments (e.g., "Encouraged me not to eat 'unhealthy foods' when I'm tempted to do so") are perceived as critical, controlling, and/or intrusive (rather than encouraging), with such behaviours known to elicit problem eating (Brewis, 2014) as well as impeding motivation to engage in healthy weight-related behaviours and success in doing so (Steiger et al., 2017; Williams, Grow, Freedman, Ryan, & Deci, 1996). Given the pervasive, socially-acceptable, and diverse forms of weight stigma that individuals with obesity experience (Brewis, 2014), comments and actions by others (even those that are well-intentioned) in relation to weight may be perceived negatively. As such, the label "Encouragement" to describe these items may be a misnomer within the obesity context. Consistent with this proposal, in a qualitative study of women with obesity regarding their perspectives on the availability and effectiveness of social support for weight control, one of the most commonly reported ineffective strategies (reported by 73% of the participants) referred to critical and/or intrusive behaviours by others such as offering unsolicited advice and pressuring the person to diet (Zwickert & Rieger, 2014). As Thoits (2011) argues, the provision of support is only helpful to the degree that it is *perceived* as supportive, and that acts of support can actually result in

negative outcomes if they "cause recipients to feel indebted, unjustly overrewarded, too dependent, overcontrolled, or incompetent in the eyes of support providers" (pp. 150-151).

Finally, there was minimal support for the SSPA Punishment subscale in terms of the expected adverse impacts of negative input from significant others (both family and friends) regarding physical activity. There were few significant correlations with this subscale, and those that were significant were in the reverse direction than expected. Specifically, this subscale was unexpectedly related to positive outcomes (e.g., the Friend version was correlated with *higher* levels of physical activity, the pros of physical activity, and the cons of consuming high fat foods). Kiernan et al. (2012) similarly found that women who lost the largest amount of weight also had the highest scores on the Punishment subscale (referred to as the Sabotage subscale in their study). While such results might reflect the fact that people engaging in higher levels of physical activity are more likely to receive negative comments from others regarding their physical activity (e.g., friends "complained about the time I spend doing physical activity"), they indicate that this subscale is not adequately indexing the behaviours of others that impede one's physical activity.

Overall, the results provided some support for the concurrent validity of the SSEH Discouragement and SSPA Participation subscales, mixed support for the SSEH-Encouragement subscale, and poor support for the SSPA Punishment subscale. Moreover, it should be noted that for those subscales for which support was found, the correlations, with one exception, were of a small effect size (i.e., $r < .30$) (Cohen, 1988). This was even the case for the alternative measure of social support for weight management (i.e., the subscales of the Quality of Relationships Inventory) for which a strong association with the SSEH and SSPA subscales was expected.

Although there was some support for the concurrent validity of the SSEH and SSPA subscales, the present study found that none of the SSEH and SSPA subscales predicted

weight loss by the end of treatment. A possible interpretation of the results is that the supportive role of the therapist and other group members may have compensated for any lack of support from family and friends for engaging in weight loss behaviours, thereby reducing the predictive power of these scales. Thus it would be of interest to assess the predictive ability of the SSEH and SSPA scales outside of the treatment setting. However, this interpretation is somewhat challenged by the finding from the same data set used in the current study that the patient's perceived support from their nominated support person in the trial (as assessed via the Support subscale of the Quality of Relationships Inventory) at baseline was a significant predictor of greater reductions in weight, BMI, and waist circumference from baseline to the end of treatment (Rieger et al., 2017).

Even though null findings obtained in treatment settings may not necessarily challenge the predictive validity of the SSEH and SSPA scales, their predictive validity in terms of weight loss is unambiguously challenged by previous research reporting results that are in the opposite direction to that hypothesised. For example, Yank et al. (2014) found that the lowest weight loss was related to participants reporting the *highest* baseline level of friend encouragement for healthy eating behaviours. Likewise, Kiernan et al. (2012) found that the most successful group for weight loss reported the most *infrequent* support for healthy eating behaviours. Finally, Wing and Jeffery (1999) reported that baseline scores on the SSEH and SSPA subscales failed to predict weight changes from baseline to 10 months in three of their four treatment conditions, while in the fourth condition greater family support for healthy eating was predictive of *less* weight loss. As with the findings testing the concurrent validity of these scales, such results suggest that items characterised as supportive of healthy eating may in fact be perceived by the recipient as critical and/or controlling, and hence have an adverse impact on weight loss.

The current study should be considered within the context of some limitations. In addition to the aforementioned issue of using a treatment sample, the current sample was predominantly female, highly educated, and urban. Gender, for example, has been found to moderate the effect of social support on obesity (Oliveira, Rostila, Leon, & Lopes, 2013). Thus, future research encapsulating a more representative sample of the general population would provide a more comprehensive examination of the psychometric properties of the SSEH and SSPA scales.

Another potential limitation pertains to power given that larger samples for scale validation are not uncommon. A power analysis via Monte Carlo simulation (e.g., Muthén & Muthén, 2002) of CFA models, assuming minimum factor loadings of .40, supported a sample size of 200, with factor loading parameters being associated with individual parameter power coefficients > .93 (for the SSEH models) and > .78 (for the SSPA three-item Punishment factor models); estimates for Participation factor loadings were all > .99. Furthermore, MacCallum et al.'s (1996) procedure for estimating power for model rejection based on the RMSEA value indicated acceptable power for the SSPA CFA models (.83), but slightly lower for the SSEH (.68) models. The latter result suggests that the study might have been somewhat underpowered for the rejection of the SSEH CFA models, and we did in fact accept one of these models (i.e., for the SSEH-Family). However, this model replicated previous work perfectly, there were no issues with power for the factor loadings, and it conformed to conceptual expectations.

In summary, the present study found support for the factor structure of the SSEH and SSPA scales, and the internal consistency of the subscales that emerged from the factor analysis. However, there was mixed support for the concurrent validity of the subscales (with strongest support for the SSEH Discouragement and SSPS Participation subscales) and no support for their predictive validity in terms of weight changes occurring over the course of a

CBT weight loss program. Overall, the results call on the obesity field to develop a psychometrically-sound measure of social support for weight-related behaviours among adults with obesity that can be used to advance knowledge, including developing tailored clinical interventions to harness effective social support for the challenging task of weight management.

References

Ball, K., & Crawford, D. (2006). An investigation of psychological, social and environmental correlates of obesity and weight gain in young women. *International Journal of Obesity, 30,* 1240-1249. http://dx.doi.org/10.1038/sj.ijo.0803267

Berkman, L. F., & Krishna, A. (2014). Social network epidemiology. In L. F. Berkman, I. Kawachi, & M. M. Glymour (Eds.), *Social epidemiology* (2nd ed.) (pp. 234-289). Oxford, UK: Oxford University Press.

Brewis, A. A. (2014). Stigma and the perpetuation of obesity. *Social Science & Medicine, 118,* 152-158. http://dx.doi.org/10.1016/j.socscimed.2014.08.003

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7,* 309-319. http://dx.doi.org/10.1037/1040-3590.7.3.309

Clark, M. M., Abrams, D. B., Niaura, R. S., Eaton, C. A., & Rossi, J. S. (1991). Self-efficacy in weight management. *Journal of Consulting and Clinical Psychology*, *59*, 739-744.

Clark, M. M., Cargill, B. R., Medeiros, M. L., & Pera, V. (1996). Changes in self-efficacy following treatment. *Obesity Research, 4,* 179-181.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cohen, S., Gottlieb, B. H., & Underwood, L. G. (2000). Social relationships and health. In S. Cohen, L. G. Underwood, & B. H. Gottlieb (Eds.), *Social support measurement and*

intervention: A guide for health and social scientists (pp. 3-28). New York, NY: Oxford University Press.

Cotter, E. W., & Kelly, N. R. (2017). Binge Eating Scale (BES). In T. Wade (Ed.), *Encyclopedia of feeding and eating disorders* (pp. 52-55). Singapore: Springer.

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., … Oja, P. (2003). International Physical Activity Questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise, 35,* 1381-1395. http://dx.doi.org/10.1249/01.MSS.0000078924.61453.FB

Gormally, J., Black, S., Daston, S., & Rardin, D. (1982). The assessment of binge eating severity among obese persons. *Addictive Behaviors, 7,* 47-55.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: *PLoS Medicine, 7,* e1000316. http://dx.doi.org/10.1371/journal.pmed.1000316

Kiernan, M., Moore, S. D., Schoffman, D. E., Lee, K., King, A. C., Taylor, C. B., … Perri, M. G. (2012). Social support for healthy behaviours: Scale psychometrics and prediction of weight loss among women in a behavioural program. *Obesity, 20,* 756-764. http://dx.doi.org/10.1038/oby.2011.293

Kolotkin, R. L., Crosby, R. D., Kosloski, K. D., & Williams, G. R. (2001). Development of a brief measure to assess quality of life in obesity. *Obesity Research, 9,* 102-111. doi:10.1038/oby.2001.13

Leahey, T. M., & Wing, R. R. (2013). A randomised controlled pilot study testing three types of health coaches for obesity treatment: Professional, peer, and mentor. *Obesity, 21,* 928-934. http://dx.doi.org/10.1038/oby.2012.179

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modelling. *Psychological Methods, 1,* 130-149.

Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling: A Multidisciplinary Journal, 9,* 599-620. doi:10.1207/S15328007SEM0904_8

Muthén, L. K., & Muthén, B. O. (2012). *Mplus user's guide*. (7th ed.). Los Angeles, CA: Muthén & Muthén.

O'Connell, D., & Velicer, W. F. (1988). A decisional balance measure and the stages of change model for weight loss. *International Journal of the Addictions, 23,* 729-750.

Oliveira, A. D., Rostila, M., de Leon, A. P., & Lopes, C. S. (2013). The influence of social relationships on obesity: Sex differences in a longitudinal study. *Obesity, 21,* 1540-1546. http://dx.doi.org/10.1002/oby.20286

Pierce, G. R., Sarason, I. G., & Sarason, B. R. (1991). General and relationship-based perceptions of social support: Are two constructs better than one? *Journal of Personality and Social Psychology, 61,* 1028-1039.

Prochaska, J. O., Norcross, J. C., Fowler, J. L., Follick, M. J., & Abrams, D. B. (1992). Attendance and outcome in a work site weight control program: Processes and stages of change as process and predictor variables. *Addictive Behaviors, 17, 35-45.*

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behaviour change. *American Journal of Health Promotion, 12,* 38-48.

Rieger, E., Treasure, J., Murray, K., & Caterson, I. (2017). The use of support people to improve the weight-related and psychological outcomes of adults with obesity: A randomised controlled trial. *Behaviour Research and Therapy, 94,* 48-59. http://dx.doi.org/10.1016/j.brat.2017.04.012

Robinson, A. H., Norman, G. J., Sallis, J. F., Calfas, K. J., Rock, C. L., & Patrick, K. (2008). Validating stage of change measures for physical activity and dietary behaviours for

overweight women. *International Journal of Obesity, 32,* 1137-1144. http://dx.doi.org/10.1038/ijo.2008.65

Sallis, J. F., Grossman, R. M., Pinski, R. B., Patterson, T. L., & Nader, P. R. (1987). The development of scales to measure social support for diet and exercise behaviours. *Preventive Medicine, 16,* 825-836.

Shaikh, A. R., Yaroch, A. L., Nebeling, L., Yeh, M. C., Resnicow, K. (2008). Psychosocial predictors of fruit and vegetable consumption adults: A review of the literature. *American Journal of Preventive Medicine, 34,* 535-543. http://dx.doi.org/10.1016/j.amepre.2007.12.028

Shao, Y., Liang, L., Shi, L., Wan, C., & Yu, S. (2017). The effect of social support on glycemic control in patients with type 2 diabetes mellitus: The mediating role of self-efficacy and adherence. *Journal of Diabetes Research, 2017,* 1-8. http://dx.doi.org/10.1155/2017/2804178

Steiger, H., Sansfaçon, J., Thaler, L., Leonard, N., Cottier, D., Kahan, E., … Gauvin, L. (2017). Autonomy support and autonomous motivation in the outpatient treatment of adults with an eating disorder. *International Journal of Eating Disorders, 50,* 1058-1066. http://dx.doi.org/10.1002/eat.22734

Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight-loss maintenance. *Joural of Personality and Social Psychology, 70,* 115-126.

Wing, R., & Jeffery, R. (1999). Benefits of recruiting participants with friends and increasing social support for weight loss and maintenance. *Journal of Consulting and Clinical Psychology, 67,* 132-138.

Yank, V., Xiao, L., Wilson, S. R., Stafford, R. S., Rosas, G. L., & Ma J. (2014). Short-term weight loss patterns, baseline predictors, and longer-term follow-up within a randomized controlled trial. *Obesity, 22,* 45-51. http://dx.doi.org/10.1002/oby.20510

Zwickert, K., & Rieger, E. (2014). A qualitative investigation of obese women's experiences of effective and ineffective social support for weight management. *Clinical Obesity, 4,* 277-286. http://dx.doi.org/10.1111/cob.12072

Table 1

Baseline Characteristics of Participants Across Treatment Conditions

Characteristic	CBT-A (n = 103) ***M (SD)***	CBT-SP (n = 98) ***M (SD)***
Age (years)	46.93 (12.01)	47.13 (11.4)
Weight (kg)	105.99 (21.32)	105.17 (20.05)
BMI (kg/m^2)	37.74 (6.58)	37.78 (6.02)
SSEH-Family-Encouragement	12.40 (5.50)	11.67 (4.94)
SSEH-Family-Discouragement	10.35 (4.22)	10.82 (4.69)
SSEH-Friend-Encouragement	8.61 (3.95)	9.29 (4.29)
SSEH-Friend-Discouragement	9.08 (3.77)	8.85 (3.29)
SSPA-Family-Participation	22.87 (8.78)	22.13 (8.49)
SSPA-Family-Punishment	2.28 (0.83)	2.52 (1.14)
SSPA-Friend-Participation	20.33 (9.13)	19.79 (8.70)
SSPA-Friend-Punishment	2.13 (0.52)	2.13 (0.51)
BES	18.32 (8.05)	17.06 (7.74)
IPAQ	3184.81 (3418.38)	2975.37 (3240.38)
DBI-Pros	39.74 (7.22)	40.39 (6.84)
DBI-Cons	23.22 (7.05)	24.69 (6.91)
WEL-Total	98.86 (28.80)	97.55 (26.36)
DF-Pros	2.41 (0.84)	2.57 (0.84)
DF-Cons	3.88 (0.81)	3.83 (0.79)
DF-Confidence	2.36 (0.81)	2.46 (0.76)

PA-Pros	4.29 (0.62)	4.18 (0.66)
PA-Cons	2.15 (0.78)	2.30 (1.24)
PA-Confidence	2.60 (0.72)	2.60 (0.76)
IWQOL-Total	76.15 (18.14)	77.01 (18.87)
	***n* (%)**	***n* (%)**
Gender (female)	72 (69.90)	76 (77.55)
Education (tertiary)	63 (61.17)	65 (66.33)
Married/de facto	58 (56.31)	54 (55.10)

Note. SSEH = Social Support for Eating Habits; SSPA = Social Support for Physical Activity; BES = Binge Eating Scale; IPAQ = International Physical Activity Questionnaire; DBI = Decisional Balance Inventory; WEL = Weight Efficacy Lifestyle Questionnaire; DF = Dietary Fats; PA = Physical Activity; IWQOL = Impact of Weight on Quality of Life

Table 2

Cronbach's Alphas for Each Measure in the Present Sample

Measure	Cronbach's Alpha
Quality of Relationships Inventory: Support	.81
Quality of Relationships Inventory: Conflict	.86
Quality of Relationships Inventory: Depth	.86
Binge Eating Scale	.84
Decisional Balance Inventory: Pros	.85
Decisional Balance Inventory: Cons	.81
Weight Efficacy Lifestyle Questionnaire	.90
Dietary Fat: Pros	.70
Dietary Fat: Cons	.69
Physical Activity: Pros	.75
Physical Activity: Cons	.60
Dietary Fat: Confidence	.79
Physical Activity: Confidence	.75
Impact of Weight on Quality of Life-Lite	.75

Table 3

Model Fit Statistics for CFA and EFA for SSEH and SSPA Scale Models

	χ^2	*df*	*p*	CFI	TLI	RMSEA	WRMR/ SRMR
CFA							
SSEH-Family	87.09	34	<.001	.982	.976	.088	0.886
SSEH-Friends	208.13	34	<.001	.927	.904	.160	1.442
SSPA-Family	**	**	**	**	**	**	**
SSPA-Friends*	556.12	64	<.001	.984	.981	.081	0.898
EFA							
SSEH-Friends – 1F	410.19	35	<.001	.844	.799	.232	.176
SSEH-Friends – 2F	86.11	26	<.001	.975	.957	.108	.052
SSPA-Family – 1F	357.78	65	<.001	.913	.895	.150	.122
SSPA-Family – 2F	251.12	53	<.001	.941	.913	.137	.109
SSPA-Friends – 1F	190.00	65	<.001	.975	.970	.098	.098
SSPA-Friends – 2F	104.27	53	<.001	.990	.985	.070	.075

Note. * = model was associated with a Heywood case (negative residual); ** = model did not converge

Table 4

Factor Loadings for the SSEH-Family and SSEH-Friends Factors

Item	Family (CFA)		Friends (EFA)	
	Factor 1[a]	Factor 2[b]	Factor 1[a]	Factor 2[b]
1. Encouraged me not to eat "unhealthy foods" (such as cake and chips) when I'm tempted to do so.	**.85**		**.69**	.30
2. Discussed my eating habit changes with me (asked me how I'm going with my eating changes).	**.89**		**.95**	-.15
3. Reminded me not to eat high fat, high sugar foods.	**.90**		**.88**	.00
4. Complimented me about changing my eating habits ("Keep it up", "We are proud of you").	**.78**		**.82**	-.07
5. Commented if I went back to my old eating habits.	**.82**		**.82**	.11
6. Ate high-sugar or high fat foods in front of me.		**.75**	-.06	**.78**
7. Refused to eat the same foods I eat.		**.69**	**.48**	**.48**
8. Brought home food I'm trying not		**88**	.25	**.65**

to eat.				
9. Got angry when I encouraged them to eat low-sugar or low-fat foods.		**.80**	**.41**	**.51**
10. Offered me food I'm trying not to eat.		**.88**	.00	**.88**

[a]Factor 1 = Encouragement; [b]Factor 2 = Discouragement
Note. Bolded values are those with a factor loading of |.40| or larger.

Table 5

Factor Loadings for SSPA-Family and SSPA-Friends Factors

Item	Family		Friends	
	Factor 1[a]	Factor 2[b]	Factor 1[a]	Factor 2[b]
1. Did physical activities with me.	**.71**	.10	**.82**	.08
2. Offered to do physical activities with me.	**.85**	.10	**.91**	-.01
3. Gave me helpful reminders to be physically active ("Are you going to do your activity tonight?").	**.59**	**.51**	**.85**	.17
4. Gave me encouragement to stick with my activity program.	**.71**	**.42**	**.86**	07
5. Changed their schedule so we could do physical activities together.	**.86**	-.04	**.87**	.19
6. Discussed physical activity with me.	**.75**	.13	**.93**	-.28
7. Complained about the time I spend doing physical activity.	.02	**.69**	.14	**.80**
8. Criticised me or made fun of me for doing physical activities.	-.25	**.76**	-.01	**.85**
9. Gave me rewards for being physically active (such as bought me something or gave me something I	**.51**	.15	**.59**	**.42**

like).				
10. Planned for physical activities on recreational outings.	**.85**	-.22	**.81**	-.07
11. Helped plan events around my physical activities.	**.88**	-.19	**.77**	.02
12. Asked me for ideas about how *they* can be more physically active.	**.70**	-.09	**.74**	-.20
13. Talked about how much they like to do physical activity.	**.72**	.00	**.89**	-.30

[a]Factor 1 = Participation; [b]Factor 2 = Rewards and Punishments
Note. Bolded values are those with a factor loading of |.40| or larger

Table 6
Correlation Results for the SSEH and SSPA Subscales with External Criteria

External Criterion Measure	SSEH-Family		SSEH-Friends		SSPA-Family		SSPA-Friends	
	Encourage	Discourage	Encourage	Discourage	Participation	Punishment	Participation	Punishment
QRI-Support	.20*	.05	.12	-.06	.20*	.02	.19	.02
QRI-Conflict	-.01	.16	.02	.11	.06	-.14	.01	.05
QRI-Depth	.03	-.02	-.05	-.19	.25*	-.17	.08	-.12
BES	.15*	.24**	.18*	.27***	-.02	-.04	.05	-.01
IPAQ	.03	-.06	.15*	-.04	.17*	.05	.18*	.20**
DBI-Pros	.19**	.15*	.09	.05	-.01	.06	.08	.09
DBI-Cons	.22**	.27***	.06	.19**	.08	.003	-.05	.03
WEL-Total	-.11	-.21**	-.13	-.12	-.05	.03	-.01	.01
WEL-Emotions	-.11	-.22**	-.15*	-.10	-.06	.02	-.03	-.01
WEL-Availability	-.07	-.05	-.07	-.06	-.08	.15*	-.02	.07
WEL-Social	-.06	-.19**	-.02	-.13	-.01	.06	.02	.03

WEL-Discomfort	-.06	-.17*	-.11	-.06	-.01	.03	.03	-.06
WEL-Activities	-.13	-.14*	-.17*	-.10	-.03	-.01	-.05	.01
DF-Pros	-.01	.13	-.05	.10	-.01	-.12	-.12	-.05
DF-Cons	.31***	.09	.20**	.06	.15*	.14	.14	.15*
DF-Confidence	-.06	-.21**	-.04	-.14	-.03	.07	.004	-.05
PA-Pros	.11	.05	.20**	.07	-.003	.11	.18*	.16*
PA-Cons	-.02	.22**	.04	.07	-.05	.01	-.14*	.06
PA-Confidence	.03	-.06	.14	.02	.17*	.08	.25***	-.01
IWQOL-Total	.03	.16*	.19**	.11	-.05	.05	-.02	.02
IWQOL-Physical	.04	.01	.17*	.04	.04	-.03	-.001	-.01
IWQOL-Esteem	-.01	.22**	.07	.10	-.10	.10	-.06	.05
IWQOL-Sex Life	-.05	.20**	.05	.01	-.23**	.03	-.08	-.004
IWQOL-Public	.08	.16*	.22**	.17*	.06	.03	.11	-.01
IWQOL-Work	.04	.03	.11	.08	-.01	.11	-.01	.05

*$p < .05$; **$p < .01$, ***$p < .001$ *Note.* QRI = Quality of Relationships Inventory; BES = Binge Eating Scale; IPAQ = International Physical Activity Questionnaire; DBI-Pros = Decisional Balance Inventory-Pros; DBI-Cons = Decisional Balance Inventory-Cons; WEL = Weight Efficacy Lifestyle Questionnaire; DF = Dietary Fat; PA = Physical Activity; IWQOL = Impact of Weight on Quality of Life

Table 7

Hierarchical Multiple Regression Testing Social Support for Health Eating as Predictors of Weight Loss

Block	IV	R^2 Change	*F Change* (df1, df2)	B (SE)	95%CI [L,U]	β	sr^2	*p*-value
Block 1		.87	390.75 (2, 115)*					
	Pre-treatment weight			.96 (.04)	[.89, 1.03]	.93	.86	<.001
	Condition			-.99 (1.34)	[-.37, 1.68]	-.03	.00	.465
Block 2		.002	1.83 (1, 114)					
	SSEH-Family-Enc			.18 (.14)	[-.09, .45]	.05	.00	.179
Block 3		.000	.044 (1, 113)					
	SSEH-Family-Enc×Condition			-.06 (.27)	[-.59, .48]	-.02	.00	.834
Block 2		.001	.68 (1, 114)					
	SSEH-Family-Disc			.12 (.14)	[-.16, .40]	.03	.00	.411
Block 3		.001	.97 (1, 113)					
	SSEH-Family-Disc×Condition			.28 (.28)	[-.28, .84]	.09	.00	.326
Block 2		.003	2.36 (1, 114)					
	SSEH-Friend-Enc			.25 (.16)	[-.07, .56]	.05	.00	.127
Block 3		.000	.21 (1, 113)					
	SSEH-Friend-Enc×Condition			-.15 (.32)	[-.78, .49]	-.04	.00	.645
Block 2		.003	2.35 (1, 114)					

	SSEH-Friend-Disc			.29 (.19)	[-.09, .67]	.05	.00	.128
Block 3		.000	.14 (1, 113)					
	SSEH-Friend-Disc×Condition			.14 (.39)	[-.63, .92]	.03	.00	.714

Note. SSEH-Family-Enc = Social Support for Eating Habits-Family-Encouragement; SSEH-Family-Disc = Social Support for Eating Habits-Family-Discouragement; SSEH-Friend-Enc = Social Support for Eating Habits-Friend-Encouragement; SSEH-Friend-Disc = Social Support for Eating Habits-Friend-Discouragement

* denotes significant at $p < .001$

Table 8

Hierarchical Multiple Regression Testing Social Support for Physical Activity as Predictors of Weight Loss

Block	IV	R^2 Change	*F Change* (df1, df2)	B (SE)	95%CI [L,U]	β	sr^2	*p*-value
Block 1		.87	390.75 (2, 115)*					
	Pre-treatment weight			.96 (.04)	[.89, 1.03]	.93	.86	<.001
	Condition			-.99 (1.34)	[-.37, 1.68]	-.03	.00	.465
Block 2		.000	.23 (1, 114)					
	SSPA-Family-Part			-.04 (.08)	[-.19, .11]	-.02	.00	.630
Block 3		.001	1.05 (1, 113)					
	SSPA-Family-Part×Condition			-.16 (.15)	[-.45, .15]	-.10	.00	.308
Block 2		.001	.02 (1, 114)					
	SSPA-Family-Pun			.09 (.66)	[-1.22, 1.40]	.01	.00	.890
Block 3		.001	.14 (1, 113)					
	SSPA-Family-Pun×Condition			.49 (1.33)	[-2.14, 3.12]	.04	.00	.713
Block 2		.001	.57 (1, 114)					
	SSPA-Friend-Part			.06 (.07)	[-.09, .20]	.03	.00	.453
Block 3		.000	.38 (1, 113)					
	SSPA-Friend-Part×Condition			-.09 (.15)	[-.39, .20]	-.06	.00	.538
Block 2		.000	.20 (1, 114)					

	SSPA-Friend-Pun			.53 (1.20)	[-1.85, 2.91]	.02	.00	.660
Block 3		.001	.88 (1, 113)					
	SSPA-Friend-Pun×Condition			-2.40 (2.56)	[-7.47, 2.67]	-.13	.00	.351

Note. SSPA-Family-Part = Social Support for Physical Activity-Family-Participation; SSPA-Family-Pun = Social Support for Physical Activity-Family-Punishment; SSPA-Friend-Part = Social Support for Physical Activity-Friend-Participation; SSPA-Friend-Pun = Social Support for Physical Activity-Friend-Punishment

* denotes significant at $p < .001$

Online Supplement Table 1

CFA Factor Loadings for the SSEH-Friends Scale

	Encouragement	Discouragement
1. Encouraged me not to eat "unhealthy foods" (such as cake and chips) when I'm tempted to do so.	.79	
2. Discussed my eating habit changes with me (asked me how I'm going with my eating changes).	.88	
3. Reminded me not to eat high fat, high sugar foods.	.88	
4. Complimented me about changing my eating habits ("Keep it up", "We are proud of you").	.80	
5. Commented if I went back to my old eating habits.	.86	
6. Ate high-sugar or high fat foods in front of me.		.64
7. Refused to eat the same foods I eat.		.83
8. Brought home food I'm trying not to eat.		.74
9. Got angry when I encouraged them to eat low-sugar or low-fat foods.		.77
10. Offered me food I'm trying not to eat.		.77

Note. Factor correlation = .54.